Rozenfel'd, I.L.

AUTHORS: Marshakov, I. K., Rozenfel'd, I. L. 76-1-10/32

TITLE: On the Mechanism of Stainless Steel Corrosion in Narrow Slits and Crevices (Mekhanizm korrozii metallov v uzkikh zazorakh. IV. Korroziya nerzhaveyuchchikh staley).

PERIODICAL: Zhurnal Fizicheskoy Khimii, 1958, Vol. 32, Nr 1, pp. 66-72 (USSR)

ABSTRACT: The method of the corrosion test applied here was described by the authors in ref. 12. Investigated were: chromium steels Нж with 3% of chromium 1X13, 2X13, X17, X28, and for reasons of comparison the ordinary steel Ст with 0,25 % of chromium. Besides these hardened steels also the steels 1X13 and 2X13 were investigated in an annealed state. The reaction against corrosion was investigated in 0,5 NaCl in tap water, in distilled water and in an allround washing of the sample by an electrolyte (1 cm^2 : 30 cm^2). The experiments showed that compared with corrosion in the electrolyte, more intense corrosion in narrow slits of steel were only observed where the same steel in the electrolyte was in passive state. A passive state can be observed with ordinary steel low in carbon and with low-alloyed steel only in special cases with an especially intensive oxygen addition or with the presence

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of other oxidation means. Under normal conditions in 0,5 N NaCl they are in an active state. So far as these steels corrode with the depolarization of oxygen their corrosion velocity in the electrolyte is higher than that in the slit where the approach of oxygen is rendered more difficult. High-alloyed steels (13 % of chromium and above) in the electrolyte are as a rule in a passive state. When these steels, however are in a narrow slit where the approach of oxygen to the metal surface is incomparably more difficult than in the electrolyte there is a much greater probability for a discontinuation of the passive state of steels and therefore also for the formation of destructions by corrosion. The authors established that with steels with 13-17% of chromium the passive state in slits is interrupted and pittings are formed. In the presence of a contact with the steel washed around by an electrolyte the corrosion of the steel in the slit intensifies at the expense of the formation of active-passive elements.- Some cons derations on the process of a destruction by corrosion are given. If the

steel has a chromium content which is not sufficient to shift it to passive state in 0,5 N NaCl the corrosion of the metal in the slit takes place as described in ref. 14. Consequent to an abrupt slowing-down of the cathode process the velocity of corrosion of such a steel will be slower than in the electrolyte. The operation of differential ventilation is little effective under these circumstances. If the steel, however, has such a chromium content that it is shifted in the electrolyte to a passive.state this steel is exposed to an increased destruction in a slit. The destruction takes place because of the fact that the entrance of oxygen to the slit is rendered more difficult and therefore the passive state of the steel in the slit is very unstable and may be disturbed at some places of the metal surface. The investigations showed that the steel is initially in a passive state and only after a certain time, which depends on the chromium content, passes over to an active state: the less chromium there is in the steel the earlier the passive state in the slit is disturbed. In fine slits the passive state can be disturbed on almost the whole

surface in the slit. With greater slits this applies only to a limited extent.
There are 6 figures, and 15 references, 5 of which are Slavic.

ASSOCIATION: Institute of Physical Chemistry, Moscow, AS USSR
(Akademiya nauk SSSR. Institut fizicheskoy khimii. Moskva).

SUBMITTED: September 29, 1956

AVAILABLE: Library of Congress

AUTHORS: Rozenfel'd, I. L., Maksimchuk, V. P. 20-119-5-40/59

TITLE: On the Passivating Properties of Sulfate Ions (O passiviruyushchikh svoystvakh sul'fat-ionov)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 119, Nr 5, pp. 986-989 (USSR)

ABSTRACT: The passive state of alloys of iron with chromium and nickel (stainless steels) is usually finished in the presence of chlorine ions and the alloys therefore are subject to corrosion in chloride solutions. Until now it has been known that the activating effect of chlorine ions by introduction of passivators into the electrolyte can be completely excluded and suppressed. The authors found and investigated a new phenomenon which speaks in favor of the following: Also sulfate ions have analogous properties with respect to chlorine ions. A diagram shows the anodic polarization curves of the steel 1X18H9T in a 0,1 solution of NaCl with various additions of sulfate. In such a solution a characteristic curvature at the polarization

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curves is observed which depends on the termination of the passive state of the electrode and its changing over into the active state. The potentials corresponding to the minima of the curves therefore can characterize the stability of the passive state. In the presence of sulfates the stability of the passive state increases. With sufficient amounts of sulfate stainless steel reacts like a passive electrode and can be polarized to relatively high values of the potentials without changing over into the active state. In order to explain the electrothermal reaction of the components of stainless steel the anodic polarization curves of iron, nickel, molybdenum, chromium and for reasons of comparison also of pure chromium steel were plotted. With iron, which has a potential of about -0,3 V, no effect was observed. With regard to chromium no activating effect of the chlorine ions can be noticed. The sulfate ions in the presence of chlorides have no influence on a molybdenum electrode. The passivating properties of sulfate ions appear clearly with regard to the solid solution iron-chromium (steel X 28). The sulfate ion also prevents an activation of nickel by chlorine ions. The passivating

On the Passivating Properties of Sulfate Ions 20-119-5-40/59

effect of the SO_4'' ions on stainless steels was to an important degree dependent on their part of chromium and to a smaller degree on the presence of nickel. Further details are given. The effect discussed can be explained satisfactorily when the processes taking place on the surface of the electrode in the presence of chlorine ions and sulfate ions are of adsorption-type character. The passivating properties of the sulfate ions are dependent on their preferred adsorption by the metal surface and by the displacement of the chlorine ions from the surface. There are 4 figures and 5 references, 4 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute for Physical-Chemistry, AS USSR)

PRESENTED: December 23, 1957, by A. N. Frumkin, Member, Academy of Sciences, USSR
SUBMITTED: December 21, 1857

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SOV/2o-122-2-26/42

5(4)

AUTHORS: Rozenfel'd, I. L., Persiantseva, V. P.

TITLE: The Influence of the Adsorption of Volatile Inhibitors on the Electrochemical Behavior of Iron (Vliyaniye adsorbtsii letuchikh ingibitorov na elektrokhimicheskoye povedeniye zheleza)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 122, Nr 2, pp 26o-263 (USSR)

ABSTRACT: This paper deals with the investigation of the electrochemical kinetics in thin electrolyte layers according to the method of I. L. Rozenfel'd (Ref 3). This method was improved in such a manner that it was possible to apply electrolyte films to the electrode surface after it had adsorbed the inhibitor from the gaseous phase without violating the hermeticity of the space. The volatile inhibitors investigated in this paper are benzylamine (C_7H_9N) and morpholine, which protect iron well from corrosion. A diagram shows the dependence of the potential of iron on the time of the previous soaking of the electrode in an atmosphere saturated by henzyl-

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amine. The adsorption of the inhibitor moves the steady potential towards the positive side. If the time of the soaking of the electrode in the atmosphere saturated by the inhibitor vapors increases, the observed effect increases, too. After a certain time, this effect acquires a constant value. The surface, obviously, is then totally saturated with the inhibitor and the potential is displaced by more than 200 mV. If there is a thin layer of electrolyte on the surface of the metal, the adsorption of the same inhibitor from the gaseous phase causes by far less intense effects. In this case, the potential of the iron is displaced only by 50-60 mV. The adsorption of the inhibitor from the gaseous phase, therefore causes more noticeable variations of the potential and, possibly, also a higher passivation degree of the electrode. The adsorption connection of the inhibitor with the metal surface and the stability of the passive state may in a certain degree be characterized by data concerning the time dependence of the potential of the metal after the saturation of the electrolyte film attached to this surface. If the time of the previous soaking of the electrode in the atmosphere com-

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posed by the inhibitor vapors increases, the potential of the metal becomes more and more stable, and no activating influence of the electrolyte is observed. Also the adsorption of morpholine has a similar influence upon the electrochemical behavior of the iron electrode. According to the above-discussed experiments and considerations, the volatile inhibitors also are adsorbed by the metal surface, and they change their electrochemical properties. The greatest displacement of the steady potential is observed after a previous adsorption of an inhibitor by the electrode from the gaseous phase. In this case, the maximum saturation of the surface with the inhibitor and a marked stability of the passive state are observed. There are 4 figures and 3 references, 3 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR
(Institute of Physical Chemistry, AS USSR)

SHCHIGOLEV, Petr Vasil'yevich; ROZENFEL'D, I.L., prof., doktor khim. nauk, otv.red.; YEGOROV, N.G., red.izd-va; RYLINA, Yu.V., tekhn.red.

[Electrolytic and chemical polishing of metals] Elektroliticheskoe i khimicheskoe polirovanie metallov. Moskva, Izd-vo Akad.nauk SSSR, 1959. 186 p. (MIRA 12:7)
(Grinding and polishing) (Metals--Finishing)

83641

S/081/60/000/015/008/014
A006/A001

18.8300

Translation from: Referativnyy zhurnal, Khimiya, 1960, No. 15, p. 82, # 60701

AUTHORS: Rozenfel'd, I.L., Pavlutskaya, T.I., Zhigalova, K.A., Akimova, T.I.

TITLE: Methods of Electrochemical and Corrosion Investigations in Thin Electrolyte Layers

PERIODICAL: Tr. In-ta fiz. khimii AN SSSR, 1959, No. 7, pp. 22-40

TEXT: Information is given on methods and devices used to investigate the electrochemical and corrosion behavior of metals under thin electrolyte layers. It is exemplified on Cu in 0.1 n. solution of NaCl, Na_2SO_4 and HCl and on Fe in 0.1 n. NaCl that a reduced thickness of the electrolyte layer entails an acceleration of the cathode process on account of facilitated O_2 reduction. A noticeable inhibition of the anode process was not observed. The authors investigated the nature of potential distribution, current density and resistivity on the electrode surfaces and the correlation of the polarization and ohmic resistivity R (ohm.). The corrosion process under thin electrolyte layers does almost not depend on R(ohm) and is mainly determined by electrode polarization, principally of the cathode. It was established that higher corrosion

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A006/A001

Methods of Electrochemical and Corrosion Investigations in Thin Electrolyte Layers

of Fe, Cu, Al and its alloys, Д 16 (D16) and В 95 (V95), in the presence of SO_2 depended mainly on the strong depolarizing activity of SO_2. Charge curves, taken in atmospheres with different moisture, are used to study the effect of the relative air moisture on kinetics of electrode processes, proceeding under thin electrolyte layers, and to determine the mechanism of O_2 transition through thin electrolyte layers (up to 0.03 cm). A method of investigating corrosion of metals by periodical moistening them with electrolytes, is described.

G. Golovina

Translator's note: This is the full translation of the original Russian abstract.

Card 2/2

PERSIANTSEVA, V.P.; ROZENFEL'D, I.L.

Laboratory methods of investigating volatile inhibitors. Trudy Inst.fiz.khim. no.7:41-50 '59. (MIRA 13:5)
(Inhibition (Chemistry)--Testing)

Rozenfel'd, I.L., and Yu.P. Ol'khovnikov. The Capacitance Method for Determining the Thickness and Continuity of Protective Paint Coatings on Metals p. 155

KOSHELEV, G.G., inzh.; ROZENFEL'D, I.L., doktor tekhn.nauk

Corrosion resistance of low-carbon and low-alloy steels in sea water. Sudostroenie 25 no.1:12-17 N '59. (MIRA 13:4)
(Steel--Corrosion)

SOV/32-25-2-24/78

8(7)

AUTHORS: Rozenfel'd, I. L., Zhigalova, K. A.

TITLE: Methodology of Investigating the Corrosion of Metals Under Condensation Conditions (Metodika issledovaniya korrozii metallov v usloviyakh kondensatsii)

PERIODICAL: Zavodskaya Laboratoriya, 1959, Vol 25, Nr 2, pp 172 - 174 (USSR)

ABSTRACT: The irregular distribution of the corrosion is characteristic of corrosion during condensation. This is explained by the fact that with all technical metals condensation is predominantly in the form of droplets (Ref 1). In the investigation of these corrosion processes the amount of condensate has to be considered. At a certain relative humidity the water vapor content of the air does not vary in proportion with temperature variation , so that at lower (5-10°) and higher temperatures (35-40°) different quantities of water will condense due to temperature variation. A glass apparatus of 300 cu.cm capacity (Fig 1) was designed by means of which it is possible to determine the quantity of water condensed at a certain temperature reduction and the corrosion. It was

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found that the corrosion is to a great extent dependent on the quantity of water condensed (Fig 2). A maximum is to be found at 2.5-3 g water per cu.dm. By drying and repeatedly wetting the corrosion spot, corrosion may be increased greatly (Fig 3). Experiments with air containing SO_2 (0.01%) or with a 0.5 n NaCl solution sprayed onto low-carbon steel St.3 showed that the corrosion is 6-9 times as strong as in the case of pure air (Fig 3). There are 3 figures and 2 Soviet references.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

5(4), 18(7) SOV/76-33-2-27/45

AUTHORS: Rozenfel'd, I. L., Marshakov, I. K.

TITLE: On the Mechanism of Metal Corrosion in Narrow Slits and Crevices (Mekhanizm korrozii metallov v uzkikh zazorakh i shchelyakh). VI. Magnesium and Some of Its Alloys (VI. Magniy i nekotoryye yego splavy)

PERIODICAL: Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 2, pp 411 - 415 (USSR)

ABSTRACT: Magnesium differs from other metals in its electrochemical properties (Refs 1-3). Since magnesium alloys are used a great deal in industry and in the construction of airplanes investigations on its properties are especially important. Magnesium with a high degree of purity, technical magnesium, and ML-5 and MA-8 alloys (chemical composition (Table 1)) were studied. The method of investigation was previously described (Ref 4). The corrosion was studied in water and NaCl solutions and it was found that it was considerably greater in narrow slits (under 0.5 mm) than elsewhere (Fig 1) and that it has a local character. Function curves in relation to the depth and size of the slits are compli-

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cated (Fig 3) and show maxima at definite values. With the MA-8 alloy no variation of the corrosion velocity in the split with the time could be observed, while it decreased with time outside the slit. Experiments involving an aeration of the electrolyte and a rotating electrode showed that the corrosion velocity increased greatly and that the character of the corrosion changed greatly (Table 2, Fig 4). It is assumed that the hydrogen bubbles given off in the slit cause a thorough intermixing and thus promote the corrosion, since they destroy and hinder the formation of protective films, thus producing the intensive pitting corrosion. The increase corrosion in the slits is limited in the case of magnesium by the formation of micro-elements. The macro-elements which are eventually produced have no particular effect. There are 3 figures, 2 tables and 4 Soviet references.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR, Moskva (Institute of Physical Chemistry of the Academy of Sciences, USSR, Moscow)

SUBMITTED: July 17, 1957

Card 2/2

AUTHORS: Rozenfel'd, I. L., Oshe, Ye. K. SOV/20-125-1-37/67

TITLE: The Effect of Ionizing Radiation on the Electrochemical Activity of Metals Coated With Semiconducting Oxide Films (Vliyaniye ioniziruyushchego izlucheniya na elektrokhimicheskuyu aktivnost' metallov, pokrytykh okisnymi plenkami poluprovodnikovogo kharaktera)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 1, pp 139-142 (USSR)

ABSTRACT: The present paper deals with the influence exercised by electronic irradiation (E = 0.8 MeV, I = 10 $\mu a/cm^2$) upon the electrochemical reaction of some metals within a range of the densities of the ionizing current. By electronic bombardment the authors tried to find a difference in the electrochemical activity of metals which on the surface exhibit semiconducting oxide films with different mechanisms of conductivity (due to electrons and holes). In this connection the activity of the metals refers to reactions on the cathode and anode. The experiments were made with zirconium and titanium with electronic mechanism of conductivity (films of the n-type) as well as with nickel and

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chromium, the mechanism of conductivity depending on the holes (films of the p-type), i.e. in distilled water, 3% NaCl and 0.1 NaOH. Irradiation with electrons reduces the excess tension of the cathodic and anodic reaction and accelerates its rate. In addition, the process is reversible: after the end of irradiation the excess tension and rate of the anodic and cathodic reaction attain their initial values. In general, these results hold for all metals under investigation which are coated with films of the n- and p-type in all electrolytes used. Metals with films of the n- and p-type react during irradiation in a way quite different from that of an anodic reaction. But the authors did not state such a difference as far as cathodic reactions are concerned. The results obtained are illustrated in a diagram. The cathodic reaction occurs on the surface of the semiconductor with the participation of electrons, whereas holes are required for an anodic reaction on the surface of the semiconductor. On the basis of these data the aforementioned difference in the anodic behavior of metals coated with films of the n- and p-type may be explained as follows: during irradiation the majority of

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oxide semiconductors usually retain their type of conductivity, even if the current carrier is excited from the valence range with the formation of a hole-electron couple. It results from the experiment that this is brought about due to the establishment of the improper carriers on the additional local levels arising from impurities or defects in the semiconductor. Consequently, the limitation of the improper charge carriers (holes) must prevent the anodic oxidation from being accelerated during irradiation of the anodic metal to be polarized. Such observations were made indeed during the irradiation of polarized zirconium and titanium at low densities of the polarizing current. The most important electro-physical properties of the semiconducting layer may be taken into account by introducing a quantity which characterizes the position of the Fermi level with respect to the energy ranges of the semiconductor. The authors thank P. Ya. Glazunov and the collective directed by him for assistance in the experiment. There are 2 figures, 1 table, and 5 references, 3 of which are Soviet.

Card 3/3 Submitted Nov 1958

PHASE I BOOK EXPLOITATION SOV/5066

Rozenfel'd, Iosif L'vovich

Atmosfernaya korroziya metallov (Atmospheric Corrosion of Metals) Moscow, Izd-vo AN SSSR, 1960. 371 p. Errata slip inserted. 5,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fizicheskoy khimii. Resp. Ed.: A. I. Golubev, Doctor of Technical Sciences; Ed. of Publishing House: A. L. Bankvitser; Tech. Ed.: Ye. V. Makuni.

PURPOSE: This book is intended for scientific and technical personnel concerned with the corrosion of metals caused by atmosphere.

COVERAGE: The book reports on the results of years of research in the atmospheric corrosion of metals by the author and his colleagues at the Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry AS USSR). On the basis of his own investigations and those of other researchers published in

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recent years in Soviet and non-Soviet periodical literature, the author presents a unified and systematic explanation of the theory of atmospheric corrosion. The mechanism and laws governing the development of atmospheric corrosion and the relation of corrosion to the composition of the atmosphere and of the alloy, the mechanism of electrochemical reactions taking place in thin films of electrolyte, convection diffusion, the adsorption of surface-active substances, the role of ohmic resistance and polarization, and ways of increasing the stability of metallic alloys against corrosion are discussed. The book directs particular attention to the theory of corrosion processes as the basis for the development of methods for corrosion protection. New data on electrochemical kinetics throw doubt on the theory to the effect that sulfur dioxide accelerates corrosion by oxidizing to sulfur trioxide to form sulfuric acid, indicating, rather, that sulfur dioxide accelerates the process of cathode depolarization. The author thanks A. I. Golubev, Doctor of Technical Sciences, Professor Z. A. Iofa, Professor S. G. Vedenkin, and Ye. I. Kalinina, and mentions the following

ROZENFELD, I. L., PERSIANTSEVA, V. P., POLTEVA, M. V., TERENTYEV, P. B., Moskva:

"A Study On The Mechanism Of Metals Protection Against Corrosion By Volatile Inhibitors".

report submitted for the European Symposium on Corrosion Inhibitors, Ferrara Italy, 29 Sep-1 Oct 1960.

ROZENFEL'D, I.L.; PAVLUTSKAYA, T.I.; LAPIDES, L.M.

Study of contact corrosion in laboratories and in natural atmospheric conditions. Trudy Inst.fiz.khim. 8:155-172 '60. (MIRA 14:4)

(Electrolytic corrosion)

S/137/61/000/006/086/092
A006/A101

AUTHORS: Koshelev, G.G., Rozenfel'd, I.L.

TITLE: Corrosion resistance of low-carbon and low-alloy steels in sea water

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 6, 1961, 50, abstract 61390 ("Tr. In-ta fiz. khimii AN SSSR", 1960, no. 8, 333 - 344)

TEXT: During six years studies were carried out in the Barents Sea. Low-alloy СХЛ1 (SKhL1), МС 1 (MS1), МК (MK) and СТ.3 (St.3) steels were used as samples. The mean corrosion rate of the steels tested in the sea, was almost the same. Consequently, alloying the small admixtures of Cr, Ni, Cu and Mn does not noticeably increase corrosion resistance of steel in the sea. Low alloy steels are different from carbon steels by the fact that they corrode less uniformly in the sea. This results in a somewhat greater reduction of their mechanical properties (by 5-8% as compared with St.3 steel). There are 7 references.

Ye. Layner

[Abstracter's note: Complete translation]

Card 1/1

MAKSIMCHUK, V.P.: ROZENFEL'D, I.L.

Use of curves of charging for investigating the phenomena of passivity and the tendency of stainless steels to pitting corrosion. Zav.lab. 26 no.3:288-290 '60. (MIRA 13:6)

1. Institut fizicheskoy khimii Akademii nauk SSSR.
(Steel, stainless--Corrosion)
(Passivity (Chemistry)(

ROZENFEL'D, I.L.; RUBINSHTEYN, F.I.; ZHEBROVSKIY, V.V.

Passivating properties of chromate pigments. Zhur. prikl. khim. 33 no.6:1292-1300 Je '60. (MIRA 13:8)
(Pigments) (Chromates)

ROZENFEL'D, I.L.; LANTSEVA, Ye.N.; KALININA, Ye.I.

Anodic oxidation of zirconium. Zhur.fiz.khim. 34 no.5:995-1003 My '60. (MIRA 13:7)

1. Akademiya nauk SSSR, Institut fizicheskoy khimii, Moskva.
(Zirconium) (Oxidation, Electrolytic)

68995
S/020/60/131/02/041/071
B004/B007

18.8300

AUTHORS: Maksimchuk, V. P., Rozenfel'd, I. L.

TITLE: Investigation of the Mechanism of the Activating Action of Chlorine Ions by Means of Tracer Atoms

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 2, pp 354 - 356 (USSR)

ABSTRACT: The authors stated in reference 6 that the activating action of chlorine ions is suppressed not only by oxidizing agents, but also by sulfate ions. They presumed that the passivation of stainless steel is caused by the adsorption of anions on the surface of the alloy. For the purpose of checking the correctness of this assumption, the adsorption of chlorine ions on a chromium electrode from a 0.1 N NaCl solution was investigated by using Cl^{36} (half-life $4 \cdot 10^5$ years) with a specific activity of 0.058 millicurie/g. The use of an electrode pressed from chromium powder instead of from stainless steel was considered to be permissible by the authors, because it is just the chromium content of stainless steel that causes the passivating action of sulfate ions. Figure 1 shows the dependence of the adsorption of chlorine ions on the potential of the electrode. In spite of equal experimental conditions, the quantity of adsorbed chlorine was different.

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[illegible] adsorption $\cdot Na_2SO_4 > 10$ [illegible] 4 that the OH^--ions have a stron[illegible] upon chlorine adsorpti[illegible]

S/137/62/000/004/143/201
A060/A101

AUTHORS: Persiantseva, V. P., Rozenfel'd, I. L., Novitskaya, M. A., Akimova, T. I., Labutin, A. L.

TITLE: The action mechanism of volatile inhibitors

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1962, 102 - 103, abstract 4I625 ("Vestn. tekhn. i ekon. inform. N.-i. in-t tekhn.-ekon. issled. Gos. kom-ta Sov. Min. SSSR i khimii", 1961, no. 2, 68 - 76)

TEXT: An investigation was carried out upon the action mechanism of volatile inhibitors by studying the adsorption processes and the action of adsorption layers upon the process kinetics of electrochemical reactions. The protective properties of a large number of compounds were preliminarily studied by the methods of accelerated tests, extended tests and testing on paper. All the tests were carried out at 100% relative humidity and at a temperature of 30°C, and also in a warehouse location. The volatile inhibitor is adsorbed by the metallic surface in the form of molecules or ions, which form as result of hydrolysis in the water film of the electrolyte (complex organic cations, hydroxyl groups, or acid

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ROZENFEL'D, I.L.; RUBINSHTEYN, F.I.; YAKUBOVICH, S.V.; KURSKAYA, A.G.

Electrochemical methods for the determination of the passivation properties of pigments in lacquer-paint coatings. Lakokras.mat. i ikh prim. no.3:50-55 '61. (MIRA 14:6)
(Pigments)
(Corrosion and anticorrosives)
(Protective coatings)

ROZENFEL'D, I.L.; MARSHAKOV, I.K.

Mechanism of selective linear corrosion. Zhur.fiz.khim. 35 no.6: 1265-1269 Je '61. (MIRA 14:7)

1. Institut fizicheskoy khimii AN SSSR i Voronezhskiy gosudarstvennyy universitet.

(Iron—Corrosion) (Dielectrics)

ROZENFEL'D, I.L.; PAVLUTSKAYA, T.I.

Distribution of the current density along the surface of local cells covered with thin layers of electrolytes. Zhur.fiz.khim. 35 no.6:1307-1314 Je '61. (MIRA 14:7)

1. Akademiya nauk SSSR, Institut fizicheskoy khimii.
(Electric charge and distribution) (Electrolytes)

ROZENFELD, I. L.

GERASIMOV, V. V., [In 1957 at the Institute of Physical Chemistry, Academy of Sciences USSR] - "Some aspects of the theory of corrosion of reactor materials in critical-parameter water" (Session 2)

LYASHENKO, V. S., and others [Names of co-authors are not given. LYASHENKO is deceased, as of August 1961. He was at the Physics-Energetic Institute, National Committee of Utilization of Atomic Energy.] - "Resistance to corrosion of austenitic and ferro-perlitic steels in a stream of liquid sodium at temperatures of 600°C and 700°C" (Session 4)

LYASHENKO, V. S., and NEVZOROV, B. A. [NEVZOROV's affiliation is not known to this office; he may possibly be at the Physics-Energetic Institute mentioned above.] - "The mechanism of carbon transfer in liquid sodium" (Session 7)

NEVZOROV, B. A. - "The nature of oxygen in liquid sodium" (Session 7)

ROZENFELD, I. L., Institute of Physical Chemistry, Academy of Sciences USSR [1960 position], and others - "The effect of composition of water on corrosion of zirconium alloys at high temperatures and pressures"

Report to be submitted for the Intl. Conference on Corrosion of Reactor Materials (IAEA), Salzburg, Austria, 4-9 June 1962.

ROZENFEL'D, I.L.; VASHKOV, O.I.

Electrochemical behavior of metals in agitated neutral electrolytes. Zashch.met. 1 no.1:70-76 Ja-F '65. (MIRA 18:5)

1. Institut fizicheskoy khimii AN SSSR.

ROZENFEL'D, I.L.; KRAMARENKO, D.M.; LANTSEVA, Ye.N.

Electrolytic hydrogen absorption by steel. Part 1: Hydrogen absorption and changes of mechanical properties during cathodic polarization. Zashch. met. 1 no.2:184-189 Mr-Ap '65. (MIRA 18:6)

1. Institut fizicheskoy khimii AN SSSR.

ROZENFEL'D, I.L.; MAKSIMCHUK, V.P. (Moscow)

Passivating properties of anions. Zhur.fiz.khim. 35 no.11:2561-2568 N '61. (MIRA 14:12)

(Passivation)
(Anions)

L 13628-66 EWT(m)/EWP(j)/T/EWP(t)/EWP(b) JD/WW/WB/RM

ACC NR: AP6003316 SOURCE CODE: UR/0365/66/002/001/0005/0024

AUTHOR: Rozenfel'd, I. L.; Persiantseva, V. P.

ORG: Institute of Physical Chemistry, AN SSSR (Institut fizicheskoy khimii AN SSSR)

TITLE: Use of inhibitors for the protection of metals against atmospheric corrosion

SOURCE: Zashchita metallov, v. 2, no. 1, 1966, 5-24

TOPIC TAGS: corrosion, corrosion inhibitor, ferrous metal, nonferrous metal, corrosion protection, nitrite, ammonium compound

ABSTRACT: A review of 89 Communist World and Western studies on inhibitors for the protection of metals against atmospheric corrosion is presented under the following headings: Protection of metals from atmospheric corrosion by inhibitors; Atmospheric-corrosion inhibitors for ferrous metals; Sodium nitrite; Dicyclohexylammonium nitrite; Inhibitors based on sodium nitrite; Composition and use of mixtures based on sodium nitrite; Cyclohexylammonium carbonate; Monoethanolammonium carbonate; Corrosion inhibitors for ferrous and nonferrous metals; Sodium benzoate; Other inhibitors. There are 39 Communist World and 50 Western references. Ten of the Soviet studies referred to have been carried out by Rozenfel'd and his associates. These studies deal with such problems as: the mechanism of action of sodium nitrite and dicyclohexylammonium nitrite, reliable

Card 1/2

UDC: 620.197.3

L 13628-66

ACC NR: AP6003316

protection methods for metals using sodium nitrite and dicyclohexylammonium nitrite, and such corrosion inhibitors for both ferrous and nonferrous metals as salts of nitro- and dinitrobenzoic acids and certain amines.
I. L. Rozenfel'd is associated with the Institute of Physical Chemistry, Academy of Sciences USSR. Orig. art. has: 10 tables. [ATD PRESS: 4169-F]

SUB CODE: 11 / SUBM DATE: 05May65 / ORIG REF: 039 / OTH REF: 050

Card 2/2

ROZENFELD, I. L. [Rozenfel'd, I.L.]; PERSIANTEVA, V.P. [Persiantseva, V.P.]; TERENTIEV, P.B. [Terent'yev, P.B.]; POLTEVA, M.N.; KUZNETOVA, M.M. [Kuznetsova, M.M.]

Studies on the influence of chemical composition, structure and certain physicochemical properties of the organic compounds upon their capacity of braking the corrosion process. Analele chimie 17 no.3:175-196 Jl-S '62.

ROZENFEL'D, I.L.; RUBINSHTEYN, F.I.; YAKUBOVICH, S.V.

Method of determining the penetrability of paint coatings to Cl-ions. Lakokras.mat.i ikh prim. no.2:58-59 '62. (MIRA 15:5)
(Protective coatings—Testing)

S/081/62/000/023/053/120
B124/B101

AUTHORS: Rozenfel'd, I. L., Rubinshteyn, F. I., Yakubovich, S. V., Persiantseva, V. P.

TITLE: Study of guanidine chromate as a corrosion inhibitor in oil paints

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 23, 1962, 411; abstract 23I334 (Lakokrasochn. materialy i ikh primeneniye, no. 3, 1962, 15-21)

TEXT: A new way to increase the protective qualities of pigmented coatings by means of modifying inert fillers and film-forming materials with corrosion inhibitors (CI) is suggested. The effect of organic CI on the properties of the oil paints was examined. It has been shown that guanidine chromate (GC) has strong passivating properties and that its effect on the oil coating is to inhibit metal ionization by anodic reaction. Conditions for obtaining corrosion-resisting oil paints are determined, with GC used as the CI. [Abstracter's note: Complete translation.]

Card 1/1

ROZENFELD, I.L., PERSIANTSEVA, V.P., TERENTIYEV, P.B.

"Mechanism of Metal protection from corrosion with the aid of volatile inhibition."

Report submitted to the Second Intl. Congress on Corrosion of Metals
New York City 11-15 March 1963

INSTITUTE OF PHYSICAL CHEMISTRY, MOSCOW

ROZENFEL'D, I.L., doktor khim.nauk

New methods of protection against corrosion. Vest.AN SSSR. 32 no.8:57-61 Ag '62. (MIRA 15:8)
(Corrosion and anticorrosives)

ROZENFELD, I.L.; RUBINSHTEYN, F.I.; YAKUBOVICH, S.V.; PERSIANTSEVA, V.P.; Prinimali uchastiye: GILLER, R.S.; KURSKAYA, A.G.

Studying chrome acid guanidine as a corrosion inhibitor for oil paints. Lakokras.mat.i ikh prin. no.3:15-21 '62. (MIRA 15:7)
(Protective coatings)
(Guanidine)

ROZENFEL'D, I.L., doktor khim.nauk

A conference on corrosion and the protection of metals. Vest. AN SSSR 33 no.6:91-92 Je '63. (MIRA 16:7)
(Corrosion and anticorrosives)

ROZENFELD, I.L.

"Electrochemistry of Volatile Inhibitors."

Report presented at the 14th meeting CITCE, Intl. Comm. of Electrochemical Thermodynamics and Kinetics, Moscow, 19-25 Aug 63.

Institute of Physical Chemistry, Academy of Sciences of U.S.S.R.

TAVADZE, F.N.; MANDZHGALADZE, S.N.; ROZENFEL'D, I.L., doktor khim. nauk, otv. red.; GORSHKOV, G.B., red.izd-va; DOROKHINA, I.N., tekhn. red.

[Corrosion and corrosion protection of metals in natural mineral waters] Korroziia i zashchita metallov v natural'nykh lechebnykh vodakh. Moskva, Izd-vo AN SSSR, 1963. 246 p. (MIRA 17:3)

TIMONOVA, Margarita Aleksandrovna; ROZENFEL'D, I.L., doktor khim. nauk, prof., retsenzent; KUNYAVSKAYA, T.M., red.

[Corrosion of magnesium alloys and their protection] Korroziia i zashchita magnevykh splavov. Moskva, Mashinostroenie, 1964. 285 p. (MIRA 17:7)

ROZENFELD, I. L.; VASHKOV, O. I.; ZHIGALOVA, K. A.

"Electrochemical processes on metals corroding in sea water."

report submitted for the Intl Cong on Fouling & Marine Corrosion, Cannes, 8-13 Jun 64.

Academy of Sciences, USSR.

ACCESSION NR: AT4010278 S/3053/62/000/000/0018/0029

AUTHOR: Rozenfel'd, I. L.; Danilov, I. S.

TITLE: Tendency of stainless steels toward pitting corrosion

SOURCE: Trudy* Vsesoyuznoy mezhvuzovskoy nauchnoy konferentsii po voprosam bor'by* s korroziyey, Baku, 1962, Moscow, 1962, 18-29

TOPIC TAGS: stainless steel, steel, corrosion, pitting corrosion, oxidation catalyst, alloy steel, passivation, corrosion, resistance adsorption

ABSTRACT: Using a special device equipped with rotating electrodes and a reflux condenser, the tendency toward pitting corrosion of stainless steels 1KH18N9T, 1KH18N12M2T, KH18N12M3T, KH18M15M2B, KH18N11B, KH28, KH17, and KH13 in a mixture of NH_4Cl as catalyst and $NH_4FE(SO_4)_2 \cdot 12H_2O$ as oxidizing agent was studied by an electrochemical method. The effect of the concentrations of the oxidizing agent and the activators on the tendency to form pits and the rate of this process was studied in the concentration range of 0.25-8% for both. The tendency to form pits increased as the concentration of the oxidizing agent increased with a maximum at 2%. The rate of pit formation reached a maximum at a catalyst concentration of 1%. At higher catalyst concentrations the tendency to form pits

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ACCESSION NR: AT4010278

was less than in electrolytes with higher concentrations of oxidizing agents. The average and maximal depths of the pits were equal in electrolytes of both types. The effect of the composition of the steel on the tendency to pit was studied on stainless steels containing Cr and Mo. The tendency decreased as the amount of CR increased confirming the fact that Cr appears to be an effective element to increase resistance to pitting. The effect of the time of exposure on corrosion was studied on Mo stainless steels. It was proved that pitting corrosion occurs mainly on the grain boundaries of the alloy and the resistance to pitting increases or decreases as the resistance to the intercrystalline corrosion increases or decreases. A positive effect of protective electrochemical passivation upon increased resistance was proved. By moving the steel potentials up to critical values of 0.15-0.25 volts, the formation of pits was completely prevented. The mechanism of pitting corrosion was explained as an adsorptive process and the analogy between corrosion in an alkaline solution and pitting corrosion was proved. Orig. art. has: 13 figures and 2 tables.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry AN SSSR)

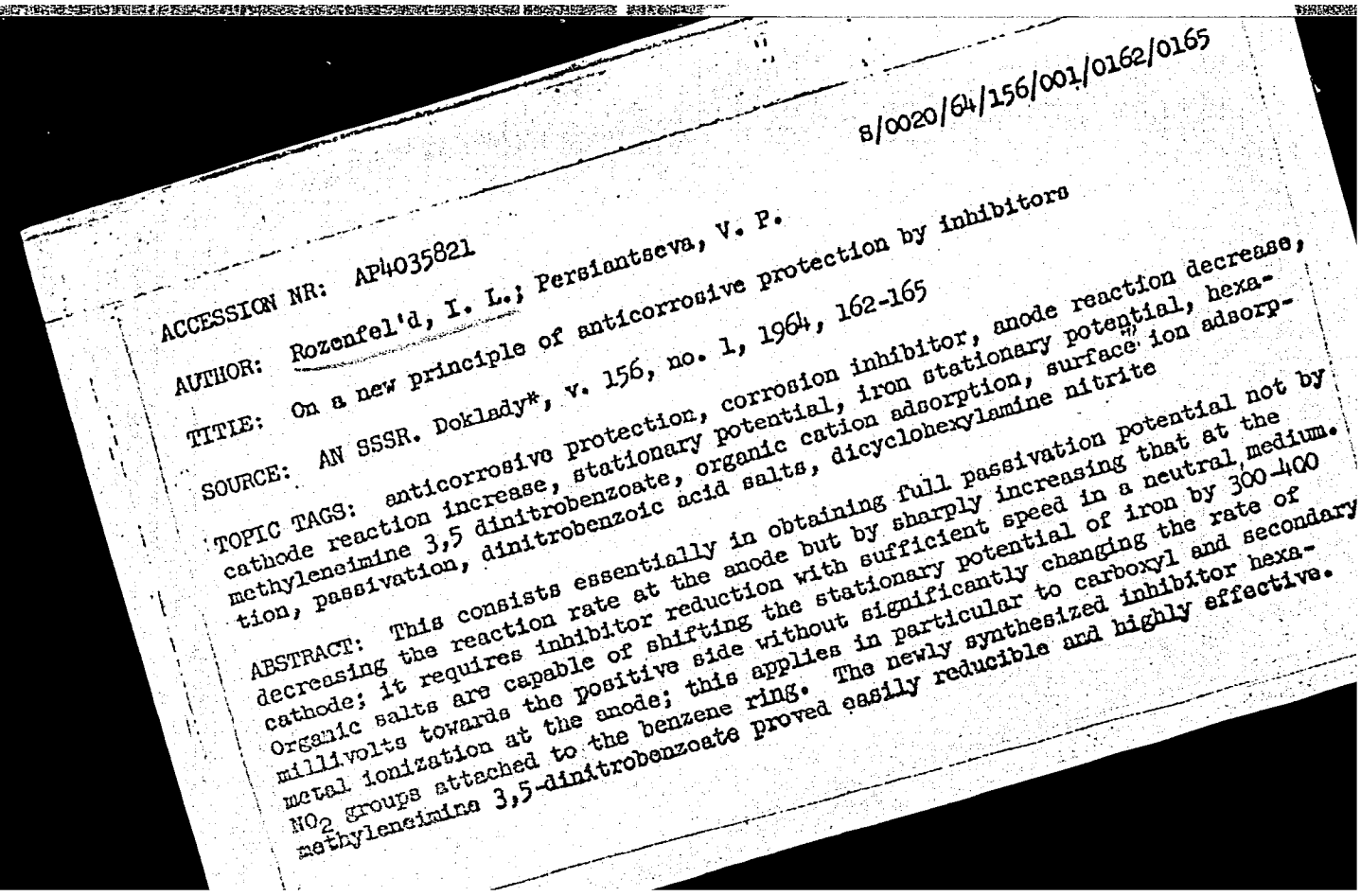
SUBMITTED: 00 DATE ACQ: 28Jan64 ENCL: 00

SUB CODE: MM Card 2/2 NO REF SOV: 008 OTHER: 003

ROZENFEL'D, I.L.; VASHKOV, O.I.

Methodology of measuring currents in corrosion elements. Zav. lab. 30 no.7:813-816 '64. (MIRA 18:3)

1. Institut fizicheskoy khimii AN SSSR.



S/0020/64/156/001/0162/0165

ACCESSION NR: AP4035821

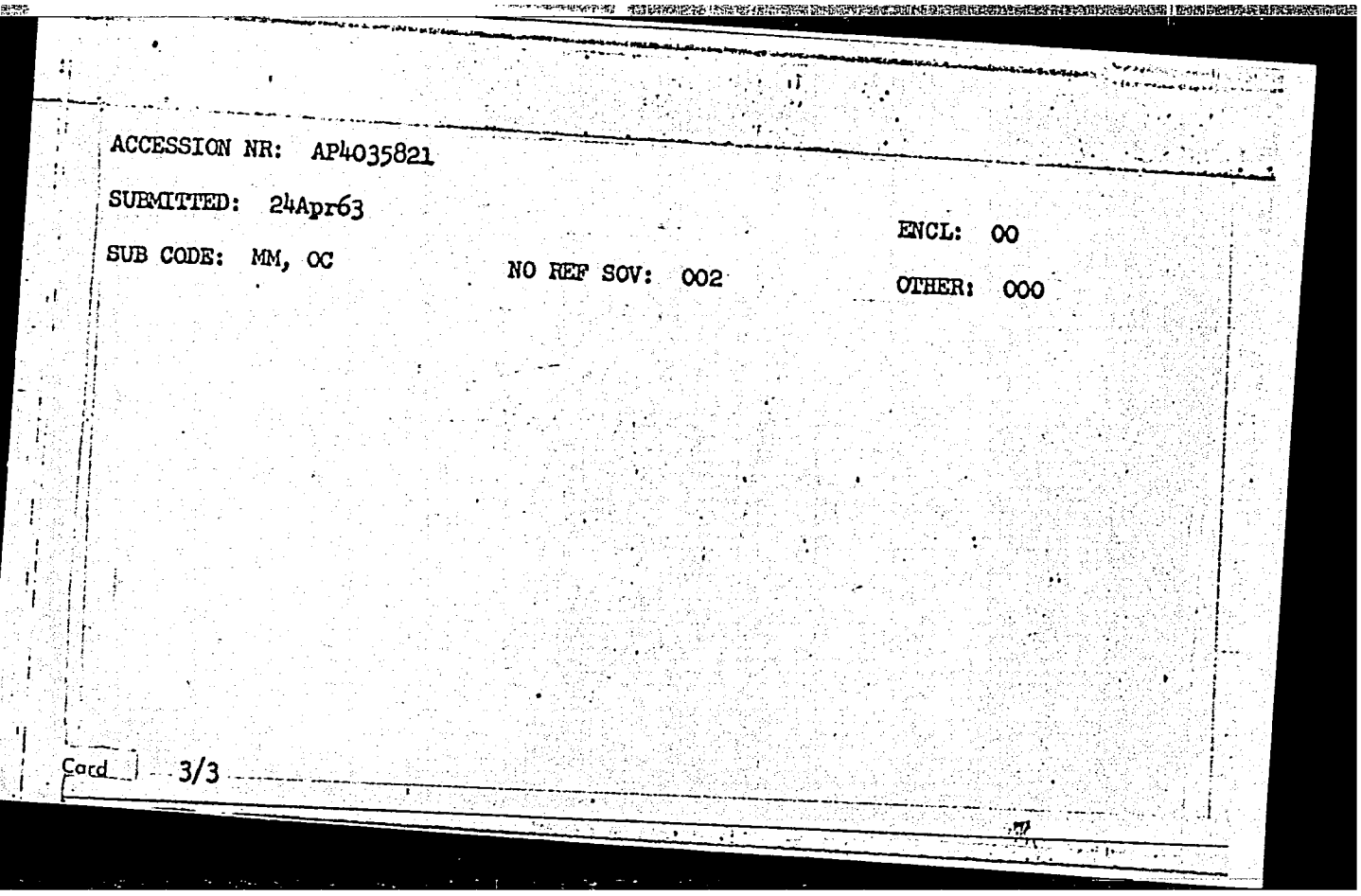
AUTHOR: Rozenfel'd, I. L.; Persiantseva, V. P.

TITLE: On a new principle of anticorrosive protection by inhibitors

SOURCE: AN SSSR. Doklady*, v. 156, no. 1, 1964, 162-165

TOPIC TAGS: anticorrosive protection, corrosion inhibitor, anode reaction decrease, cathode reaction increase, stationary potential, iron stationary potential, hexamethyleneimine 3,5 dinitrobenzoate, organic cation adsorption, surface ion adsorption, passivation, dinitrobenzoic acid salts, dicyclohexylamine nitrite

ABSTRACT: This consists essentially in obtaining full passivation potential not by decreasing the reaction rate at the anode but by sharply increasing that at the cathode; it requires inhibitor reduction with sufficient speed in a neutral medium. Organic salts are capable of shifting the stationary potential of iron by 300-400 millivolts towards the positive side without significantly changing the rate of metal ionization at the anode; this applies in particular to carboxyl and secondary NO_2 groups attached to the benzene ring. The newly synthesized inhibitor hexamethyleneimine 3,5-dinitrobenzoate proved easily reducible and highly effective.



ACCESSION NR: AP4035821

SUBMITTED: 24Apr63 ENCL: 00

SUB CODE: MM, OC NO REF SOV: 002 OTHER: 000

Card 3/3

ACCESSION NR: AT4010277 S/3053/62/000/000/0006/0018

AUTHOR: Rozenfel'd, I. L. ; Maksimchuk, V. P.

TITLE: The passive state of stainless alloys in the presence of chloride ions

SOURCE: Trudy* Vsesoyuznoy mezhvuzovskoy nauchnoy konferentsii po voprosam bor'by*s korroziyey, Baku, 1962. Moscow, 1962, 6-18

TOPIC TAGS: alloy, alloy steel, stainless steel, nickel alloy, chromium alloy, corrosion, corrosion resistance, chloride ion activation, passive state, anode polarization

ABSTRACT: It is well known that stainless alloys which show marked stability in oxidizing media can readily be activated in the presence of chloride ions. The mechanism of this activation, however, is not yet clear. In the present paper, a new electrochemical method, based on anode polarization, has been used to study the effect of alloy composition and the presence of other anions on the activation of stainless alloys by chloride. As was also indicated by practical observations, the corrosion resistance of stainless steel in 0.1 N NaCl was found to increase in the order 1Kh18N9T < Kh18N12M2T < Kh18N12M3T. Similarly, the corrosion resistance of a number of alloys in the Fe-Cr, Ni-Cr, Fe-Ni-Cr and

ACCESSION NR: AT4010277

Fe-Ni-Cr-Mo systems was found to depend on the type and amount of alloying elements. In the Fe-Cr and Ni-Cr systems, the resistance to chloride increased with the Cr content, while Fe was always in the active state; Ni and especially Mo, although fairly readily activated by chloride, contribute to the stability of the passive state by altering the alloy structure. Studies on the inhibitory effect of other anions on activation of Kh18N9T steel by chloride showed that the passive state is stabilized by $NO_3 > ClO_3 > ClO_4 > CrO_4 > SO_4$. There is thus no definite relationship between the oxidizing activity of anions and their effectiveness in maintaining the passive state. Finally, the mechanism of these effects was studied by investigating the adsorption of isotopically labeled chloride (Cl^{36}) to Cr electrodes in the presence of various anions; these studies showed that adsorption of Cl can be prevented by sulfate and hydroxyl ions, and that these ions can even displace Cl from the electrode, thus preventing activation of the metal. This is interpreted to favor the adsorption theory of Cl ion activation. Orig. art. has: 17 figures and 3 tables.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry AN SSSR)

Card 2/3

ACCESSION NR: AT4010277

SUBMITTED: 00

DATE ACQ: 28Jan64

ENCL: 00

SUB CODE: MM

NO REF SOV: 007

OTHER: 002

Card 3/3

S/844/62/000/000/033/129
D214/D307

AUTHORS: Oshe, Ye. K. and Rozenfel'd, I. L.

TITLE: The influence of electron irradiation on the electrochemical and corrosion behavior of metals

SOURCE: Trudy II Vsesoyuznogo soveshchaniya po radiatsionnoy khimii. Ed. by L. S. Polak. Moscow, Izd-vo AN SSSR, 1962, 199-206

TEXT: The electrochemical and corrosive effects brought about by the exposure of electrodes to 0.8 Mev electron radiation of current density 10 $\mu a/cm^2$ was studied. By irradiating an oxide electrode exhibiting p-type conductivity, the anode reaction goes through the valency zone of the oxide and the electron holes participate in the reaction. The rate of reaction was faster and the overvoltage (η) was lower than in electrodes exhibiting n-type conductivity in their oxide layer. The influence of the type of conductivity on η and on the reaction rate in cathode reactions was not determined. The build-up of the radiochemical current (i) and its fall, after

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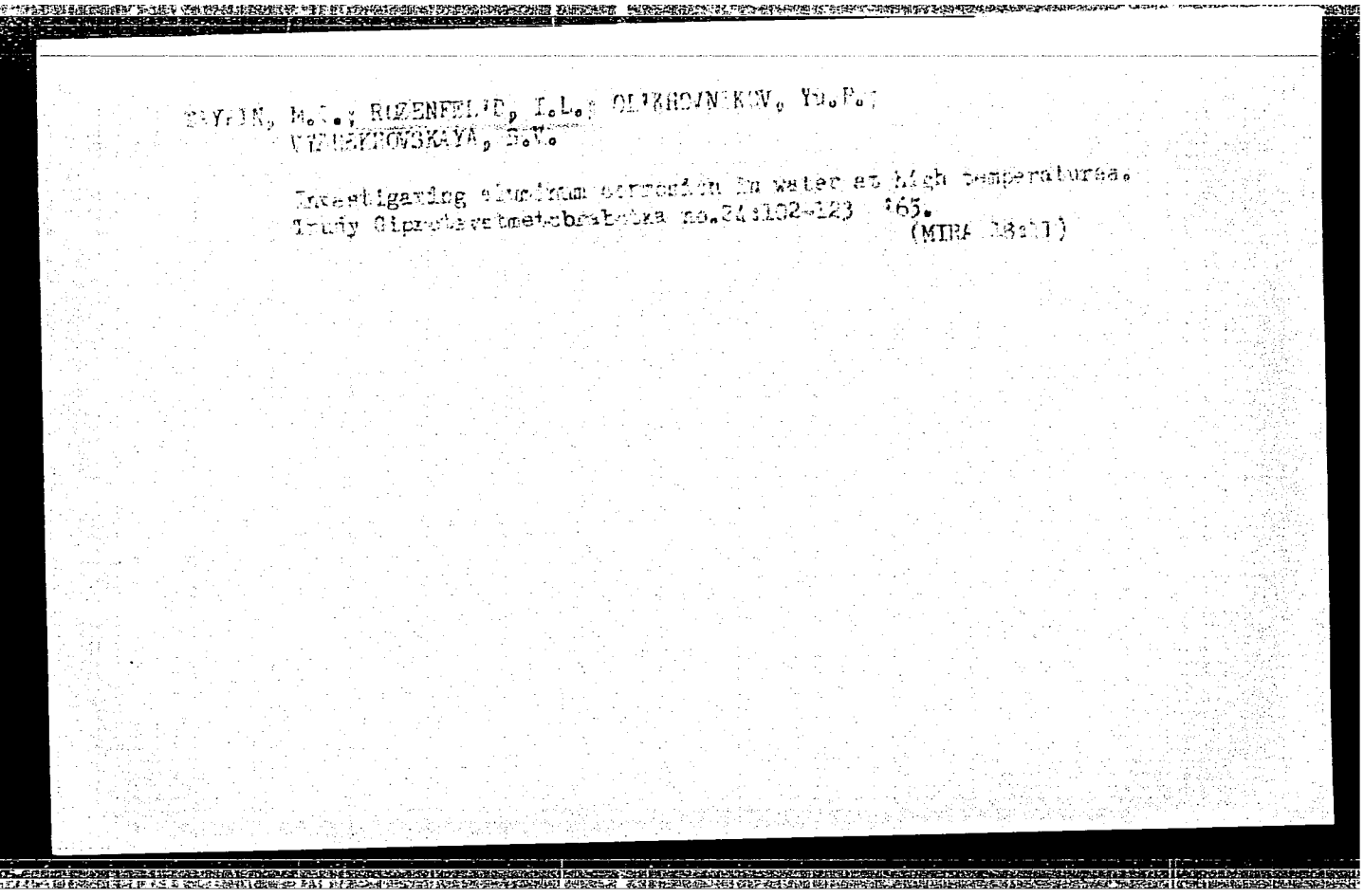
the irradiation was terminated, was not instantaneous owing to the slow filling of the electron holes and the thermal destruction of the majority of carriers. The time-current curves were very similar to those obtained for irradiated, dry photoconductors. The current i was greater than the number of liberated electrons and the increase was defined as the amplification coefficient, (α). The quantity α is thus a measure of electrons liberated for every excited electron participating in the electrochemical reaction. The thicker the oxide film on the irradiated electrode, the lower i and the weaker is the corrosive action of the radiation. The corrosive current also decreases as the concentration of O_2 in the electrolyte becomes lower. There are 5 figures and 5 tables.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry, AS USSR)

ROZENFEL'D, I.L.; PERSIANTSEVA, V.P.; KUZNETSOVA, M.M.; POLTEVA, M.N.; TERENT'YEV, P.B.

Electrochemical behavior of metals in the atmosphere of volatile inhibitors. Zhur.prikl.khim. 34 no.10:2239-2244 O '61. (MIRA 14:11)

(Metals) (Electrochemistry) (Inhibition (Chemistry))



[illegible], M.I.; RIZENFEL'D, I.L.; OLYKHOVNIKOV, Yu.P.; [illegible]

Investigating aluminum corrosion in water at high temperatures. Trudy Giprovostokneftemontazhstroya no.2:102-123 '65. (MIRA 18:11)

ROZENFEL'D, I.L., NOVITSKAYA, M.A., SELEZNEVA, T.V.

Self-dissolving of the Kh18N9T stainless steel in binary systems HNO_3 - HCl, HNO_3 - HF and the ternary system HNO_3 - HCl - HF. Zashch. met. 1 No.3:265-271 My-Je '65. (MIRA 18:8)

L 2625-66 EWT(m)/EWP(w)/T/EWP(t)/EWP(b)/EWA(c) JD

ACCESSION NR: AP5011362 UR/0365/65/001/002/0184/0189
620.193.4
620.197.5

65
62
B

AUTHOR: Rozenfel'd, I. L.; Kramarenko, D. M.; Lantseva, Ye. N. 44,55 44,55 44,55

TITLE: Electrolytic hydrogen absorption of steel. I. Hydrogen absorption and change in mechanical properties of steel during cathodic polarization 15

SOURCE: Zashchita metallov, v. 1, no. 2, 1965, 184-189

TOPIC TAGS: steel industry, hydrogen, tensile stress, elasticity, solid mechanical property

ABSTRACT: A device is described for measuring the hydrogen absorption by steel during cathodic polarization. The method is based on the dependence of steel sample length upon hydrogen content. The principles of electrolytic hydrogenation of steel were examined by means of four independent methods. Also, the effect of the quantity of absorbed hydrogen on the sample's plasticity and tensile strength was investigated. A drawing of the device is shown in fig. 1 of the Enclosure. A typical dependence of sample length increment upon the polarization duration at

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L 2625-66
ACCESSION NR: AP5011362

constant current density (50 mA/cm^2) is shown in fig. 2 of the Enclosure. Orig. art. has: 1 table, 4 figures.

ASSOCIATION: Akademiya nauk SSSR, Institut fizicheskoy khimii (Academy of Sciences SSSR, Institute of Physical Chemistry)

SUBMITTED: 21Oct64 ENCL: 02 SUB CODE: MM, GC

NO REF SOV: 015 OTHER: 009

Card 2/4

L 2625-66

ACCESSION NR: AP5011362

ENCLOSURE: 01

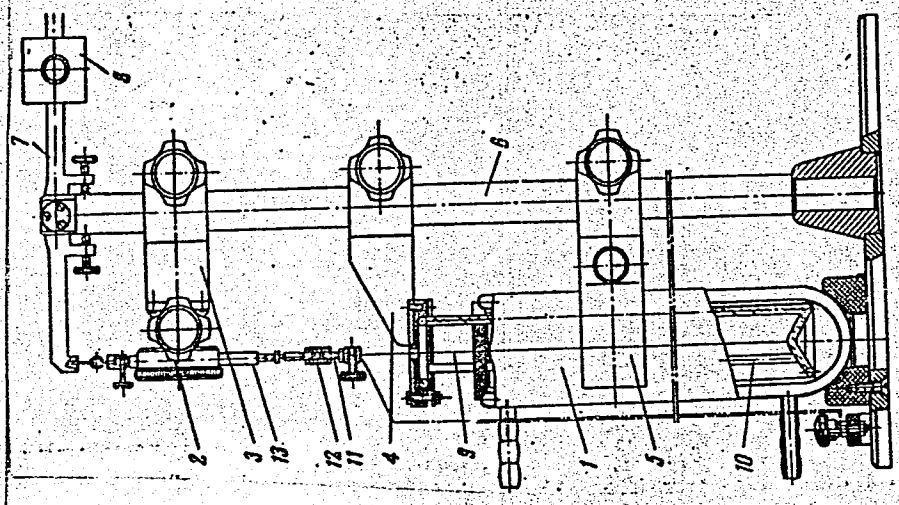

Fig. 1. 1--electrolytic cell; 2--indicator; 3 and 4--cantilevers; 5.--clamp; 6--vertical stand; 7--arm; 8--load; 9--wire sample; 10--glass insert; 11--crossover screw; 12--special plastic nut; 13--indicator's rod.

Card 3/4

L 2625-66

ACCESSION NR: AP5011362

ENCLOSURE: 02

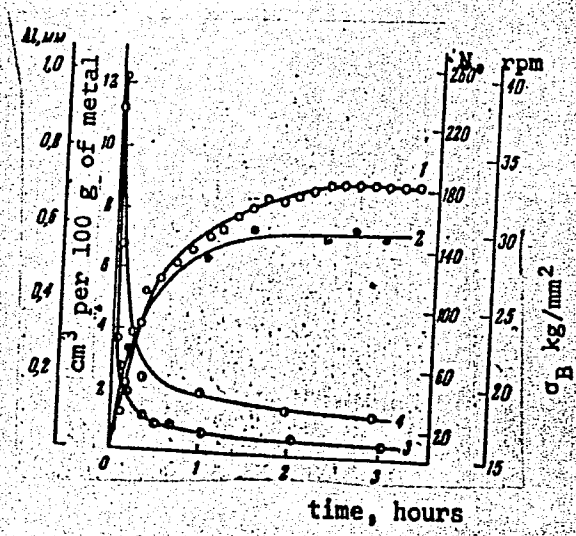

Fig. 2. 1--length increment (Δl); 2--quantity of absorbed hydrogen (v_{H_2}); 3--rpm during twisting (N); 4--tensile strength (σ_B).

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L 5219-66 EWT(m)/EPF(c)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b)/EWA(c) IJP(c) MJW/JD
ACCESSION NR: AP5022653 UR/0365/65/001/005/0473/0476
620.193.41
669.788

AUTHOR: Rozenfel'd, I. L.; Kramarenko, D. M.; Lantseva, Ye. N.

TITLE: Electrolytic hydrogenation of steel. II. Effect of temperature

SOURCE: Zashchita metallov, v. 1, no. 5, 1965, 473-476

TOPIC TAGS: hydrogenation, electrolysis, vacuum technique, low carbon steel

ABSTRACT: The effect of temperature on the quantity of hydrogen absorbed by steel during electrolysis is studied. The hydrogen contents are determined by vacuum extraction and by using expansion results. Wire samples (0.5 mm diameter) were of the following composition: C--0.61%; Si--0.24%; Mn--0.46%; and S--0.012%. For comparison, another steel of the same dimensions but of lowered C content (0.024%) was used, as well as sheets of Ct. 3 (40 × 10 × 3.5 mm) and 30KhGSA (40 × 10 × 1 mm). Hydrogenation was done electrolytically in a 1 N H_2SO_4 + 100 mg/l As_2O_3 solution. The extent of hydrogenation is given as a function of time and temperature (25, 45, 65, 85°C). The expansion curves are correlated with $\ln V_{H_2}$. The maximum absorbed

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hydrogen content decreases with increasing temperature of hydrogenation. The results for the 0.61% C steel are presented below for a current density of 20 ma/cm^2:

Temperature, °C	25	45	65	85
Maximum H_2 content absorbed cm^3/100 g of metal	5.00	4.40	3.50	2.70
Limiting expansion value Δl, mm	0.33	0.28	0.20	0.12

Results are similar for different shapes or forms, i.e., samples of diameters 1 and 1.5 mm and sheets of 1 and 3.5 mm thickness. Results are analogous for the other steels, although the degree of hydrogenation is a function of composition. For lowered carbon levels (30KhGSA) the effect of temperature is more pronounced. The speed of hydrogenation increases with temperature in all cases. For equilibrium conditions the relationship between $\ln V_{H_2}$ and temperature (τ) is given by:

$$V_{H_2} = ke^{Q/RT},$$

3

where k and Q are constants. Q was found to be 3.3 kcal/mol for a current density of 50 and 2.5 for a current density of 20 ma/cm^2. The value for the activation energy, calculated from the Arrhenius equation, was found to be 1.7 kcal/mol. This value is indicative of a diffusion process in the metal. The reaction equations at the anode were given as:

$$H_3O^+ + e^- = H_{ads} + H_2O \quad (1)$$

$$H_{ads} + H_3O^+ + e^- = H_2 + H_2O \quad (2)$$

$$H_{ads} + H_{ads} = H_2 \quad (3)$$

Reactions (2) and (3) show temperature effects and the influence of absorption. These experiments are compared to those in which no As_2O_3 was added to the acid solutions. In the latter experiments the amount of absorbed hydrogen decreased, indicating that a different mechanism is operative. Orig. art. has: 3 figures, 1 table.

ASSOCIATION: Akademiya nauk SSSR, Institut fizicheskoy khimii (Academy of Sciences SSSR, Institute of Physical Chemistry)
SUBMITTED: 14May65 ENCL: 00 SUB CODE: GC, MM
NO REF SOV: 007 OTHER: 004

L 1292-66 EWT(m)/EPF(c)/EWP(c)/EWA(d)/EWP(t)/EWP(k)/EWP(z)/EWP(b) JD/WB
ACCESSION NR: AP5025502 UR/0365/65/000/003/0265/0271

AUTHOR: Rozenfeld, I. L.; Novitskaya, M. A.; Selezneva, T. V. 45 B

TITLE: Dissolving of Kh18N9T stainless steel in the binary systems HNO_3--HCl, HNO_3--HF and the ternary system HNO_3--HCl--HF

SOURCE: Zashchita metallov, no. 3, 1965, 265-271

TOPIC TAGS: stainless steel, solution property, metal etching, electrolyte / Kh18N9T stainless steel

ABSTRACT: In view of the contradictory requirements of current technology, in which apparatus must be made of stainless steel for etching processes ranging in scope from high-speed chemical milling to slow scale removal requiring minimum weight loss, no one electrolyte can be universally applied. The authors have attempted to devise a ternary diagram permitting selection of the proper etching agent from the system HNO_3--HCl--HF on the basis of the corrosion rate on steel. The dissolving of Kh18N9T steel in HNO_3--HCl, HNO_3--HF and HNO_3--HCl--HF was investigated. Etching rate was related to composition, and a ternary diagram was plotted. The diagram shows the electrolytes whose composition provides the most rapid etching,
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L 1292-66
ACCESSION NR: AP5025502

which can be used for chemical milling, as well as those whose rate is suitable for usage as scale removers. Electrolytes which provide bright surfaces were found. The following scale-removing electrolyte was developed and tested in production conditions: HNO_3, 220-240 g/l; NaF, 20-25 g/l; NaCl, 20-25 g/l. Etching time was 5-60 min at room temperature, dissolving rate 25-30 $g \cdot m^2 \cdot hr$. An accelerated method for testing the stability of the passive state of stainless steels after technological treatment, consisting of 10 hr exposure to an atmosphere of 98% relative humidity and containing sulfur anhydride as a depolarizer, is suggested. It is shown that etching Kh18N9T steel in the proposed electrolyte sharply increases its stability in the atmosphere. Orig. art. has: 1 figure and 4 graphs.

Moscow, Zashchita Metallov, No 3, May-Jun 65, pp 265-271.

ASSOCIATION: none

SUBMITTED: 07Feb64 ENCL: 00 SUB CODE: MM, GC

NR REF SOV: 008 OTHER: 004 JPRS

Card 2/2

25786
S/020/61/139/002/016/017
B103/B220

18.8300

AUTHORS: Rozenfel'd, I. L., and Danilov, I. S.

TITLE: Mechanism of formation and development of pitting corrosion on stainless steels

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 2, 1961, 414-417

TEXT: It is stated that the rules applying to the developemt of pitting are still far from being clear. Pitting develops on the surface of alloys in passive state due to local activation of chlorine ions. In the opinion of the authors, origin and development of pitting corrosion are subject to the presence of a passivator (besides the activator). The probability of the process (number of pittings) and the rate of its development (mean depth of pittings) are a complex function of the interrelation between the concentrations of passivator and activator. If the latter remains constant, the appearance of pittings is highly favored by increasing concentration of the passivator, begins, however, to decrease with high concentrations of the passivator. The increase of the content of chlorine ions (activator) favors the development of pitting corrosion only up to a certain concentra-

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Mechanism of formation and development ...

tion; then it decreases (Figs. 1A and Б, steel 1Х18Н9Т (1Kh18N9T), curves 1). The authors think that the much greater probability of a development of pitting corrosion in electrolytes with high passivator concentration compared to those with high activator concentration is rather striking. The rate of penetration of the passivator into the metal increases with increasing concentration of the activator as well as of the passivator only up to a certain limit. A further concentration increase of one of the components of the mixture reduces the average depth of penetration of the corrosion (Figs. 1A and Б, curves 2). Apparently, activator and passivator act here in the same direction. With low concentrations, they augment the probability of a development of pitting corrosion and accelerate the latter, the contrary happens with high concentrations. These results are thought somewhat surprising based on the film theory of the activating effect of chlorine ions. They found, however, an explication for these rules and the apparent inconsistencies in the quantitative analysis of the data concerning the development rate of the process at individual points by considering the conception of the adsorbing nature of the activation and passivation processes (G. Ulig, Ref. 2: Korroziya metallov (Corrosion of metals), Sborn. perevodnykh statey pod. red. V. V. Skorcheletti, 1, 1952, p. 61;

Card 2/5

Mechanism of formation and development ...

L. V. Vanyukova, B. N. Kabanov, Ref. 3: ZhFKh, 28, 1025 (1954); B. V. Ershler (Ref. 6: Tr. 2-y konfer. po. korrozii metallov (Papers of the 2nd Conference on Corrosion of metals), 2, 1943, p. 52). They distributed all pittings developed according to their size. The typical distribution curve thus obtained proves that the process develops very irregularly at different points (at rates varying by a factor of about forty). Many medium-sized and few small and deep pittings are formed. The distribution curves are shifted to the left with increasing concentration of the oxidizer, except for their right arms which are shifted to the right. Therefrom it is concluded that the process is delayed in most points. Only a few active centers (~ 2-3%) remain where the process progresses intensively. Here the depth of corrosion augments continuously with increasing concentration of activator and passivator (Figs. 1A and 5, curves 3). The curves of Fig. 3 indicate that there exist also chronological differences in the development of pittings. In most points the process is slackened down in the course of time. Part of the small pittings cease completely to grow. Since the said activation largely depends on the electrode potential, the authors think of a surface phenomenon. Based on the data of the authors and of Ref. 2, activation may occur only with rather high positive potentials +0.15-0.20 V.

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Based on the film theory, oxide layers may be decomposed at any potential. The potential of stainless steel in ammonium chloride is more negative than the critical potential and, thus, the probability of a development of pitting corrosion is zero. By introduction of the passivator and increase of its concentration, the potential is displaced more and more to the positive side. Thus, the adsorption of the positively charged chlorine ions is facilitated on the one hand but, on the other hand, these ions become more active. The probability of pitting corrosion is increased by all these facts. From a certain concentration of the oxidizer onward, this displacement in potential cases, whereby the adsorption of chlorine ions is said to be not increased. From this moment, the probability of pitting corrosion does not increase any more. Moreover, the adsorption of chlorine ions is prevented by the increasing ratio between passivator concentration and activator concentration. Consequently, also the probability of pitting corrosion has to decrease (tests made by the authors with Cl^{36} (I. L. Rozenfeld, V. P. Maksimchuk, Ref. 10: DAN, 131, No. 2, 354 (1960)). The cathodic reaction is accelerated with increasing concentration of the oxidizer, accompanied by an increase of the rate of the coupled anodic reaction which causes the corrosion to penetrate into the metal. From a certain

Mechanism of formation and development ...

concentration of the oxidizer the current density reaches in most pittings a value which is able to inhibit the anodic reaction considerably and effects in some even an anodic passivity. This slackens the process in most points. In few points only, the current density is not sufficient for the inhibition so that the process progresses. For these reasons, favorable conditions for a rapid development of the process are obtained in the active centers. The potential of the steel is deplaced more and more to the negative side with increasing concentration of the activator. Thus, the adsorption of chlorine ions is made difficult and the probability of pitting corrosion reduced. The process is delayed with high concentrations of chlorine ions by the formation of special phase layers. Pitting corrosion is considered by the authors a special form of chink corrosion. It has to be interpreted based on the conceptions of I. L. Rozenfel'd and I. K. Marshakov (Ref. 11: ZhFKh, 30, 2724 (1956); 31, 2328. (1957); 32, 66 (1958)). There are 4 figures and 11 references: 9 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR).

Card 5/6

18.8300 4016 2808 1418

S/076/61/035/008/014/016
B110/B101

AUTHORS: Rozenfel'd, I. L., and Maksimchuk, V. P. (Moscow)

TITLE: Passivity of stainless alloys in chloride solutions

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 8, 1961, 1832 - 1838

TEXT: The causes of the activation of stainless, highly oxidation-resistant alloys by electrolytes containing chlorine ions are as yet unknown. The results obtained from an investigation of the effect of alloy composition upon the condition of stainless alloys are presented here. Passivation with anodic polarization served as a standard. The authors (Zavodsk. laboratoriya, 1959) showed that the method of charge curves taken in the automatic potential recording was suited for studying passivity. The automatic electron potentiometer ЭПП-09 (EPP-09) was connected to the emf over a d-c amplifier with an input resistance of 10^8 ohms. When recording the curves, the current strength in the circuit was stabilized by a 10^7 ohm resistance connected in series with the electrochemical cell. Samples with 0.5 cm^2 open surface and placed in polystyrene cases were ground, degreased, and kept for 12 - 24 hr in the exsiccator. A calomel electrode

Passivity of stainless...

served for a reference. The following steel types were examined in a 0.1 N NaCl solution: 1Х13 (1Kh13); Х17 (Kh17); Х28 (Kh28); 1Х13М2 (1Kh13M2); 1Х18Н9Т (1Kh18N9T); Х18Н12М2Т (Kh18N12M2T); Х18Н13М3Т (Kh18N13M3T); Х20Н80 (Kh20N80); Х30Н70 (Kh30N70); Х50Н50 (Kh50N50); in addition, Fe, Ni, Cr, Mo. The alloys polarized up to a potential ("activation potential"), at which they passed over into the active state. The said potential characterizes the resistance of alloys to the activating action of chlorine ions. Curves 1, 3, 5 (Fig. 1) concerning chromium steels present a rising passivation against chlorine ions with growing Cr content; the overvoltage of the ionization reaction of the alloy is thereby caused to rise. From among individual steel components: Fe, Mo, Ni, and Cr, the latter is passivated the easiest. Fe remains active. The rates of anodic dissolving of Ni and Mo remain almost the same, as they do not undergo any strong anodic polarization. Thus, a chromium content favors passivation. Fe and Ni in binary solutions with Cr display almost the same behavior. Ni addition to Fe-Cr alloy, however, raises passivation. Thus, with equal Cr content, 1Kh18N9T steel is polarized more strongly than Kh17 (Fig. 1), because Ni modifies the alloy structure by an austenite formation. Various sets of the same Kh18N12M2T with equal chemical composition differed in their

Passivity of stainless...

behavior due to differences in structure. Whereas ferrite structure diminished anodic passivation, austenite structure increased it. Ni-Cr alloys are passivated at high current densities. The threshold of current density effecting passivation drops with rising Cr content (Kh50N50: 100$\mu a/cm^2$; N70Kh30: 2000$\mu a/cm^2$; N80Kh20: 10 ma/cm^2). The $Cr_2O_7^{2-}$ ions resulting from the anodic polarization of Cr alloys probably suppress the activating action of chloride ions. In the presence of sufficiently high positive potentials, chromium alloys dissolve to form $Cr_2O_7^{2-}$. Due to selective dissolution, the surface is enriched by the second component, Ni or Fe. $Cr_2O_7^{2-}$ ions accumulated in the solution near the electrode passivate the Ni surface of a Ni-Cr solution to a higher degree than the Fe surface of a Cr steel. A chlorine ion action upon Ni is already fully suppressed with a chromate concentration: $c_{CrO_4^{2-}} / c_{Cl^-} \gg 10$, but not yet with Fe for $c_{CrO_4^{2-}}/c_{Cl^-} = 25$. Molybdenum content also passivates:

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Passivity of stainless...

Kh18N12M2T and Kh18N12M3T steels are polarized more strongly than 1Kh18N9T (Fig. 1). Mo content likewise influences the corrosion structure of steels and reduces the number of pittings. The diagrams of Fig. 6 consist of two parts: (I) at a low strip-chart speed, the entire course of potential change is observed during 90 min; (II) at a high strip-chart speed, individual changes in a narrow timespan are observed. The steep potential change after switching on corresponds to the load of a twofold electric layer; in this case, the potential of stainless steels becomes unstable due to chlorine ion action. Frequency and boundaries of oscillations depend upon composition. A Mo addition to NiCr steels causes the upper and lower oscillation boundaries to shift toward positive values. Thus, Kh18N12M3T must have most positive potentials with the least changes. The authors (Dokl. AN SSSR, 1960, 131, No. 2) used radioactive indicators to show the adsorption character of the surface activation by chlorine ions. A positive shift of potential renders the adsorption of the latter easier. The dislodge loosely bound oxygen; this disturbs passivation. As the potential drops, active-passive galvanic cells operate. The total potential shifts toward negative values with desorption and a drop of the activating action of Cl ions. The adsorbed residual oxygen effects passivation as the cycle

26550
S/076/61/035/008/014/016
B110/B101

is repeated. The appearance of pittings gives rise to activity of local galvanic cells, and the total potential turns negative as activation drops. Thus, pittings acting as punctiform protectors prevent the formation of corrosion centers in the neighborhood. There are 6 figures, 2 tables, and 9 references: 8 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publications reads as follows: M. A. Streicher, J. Electrochem. Soc., 103, 375, 1956.

ASSOCIATION: Akademiya nauk SSSR, Institut fizicheskoy khimii (Academy of Sciences USSR, Institute of Physical Chemistry)

SUBMITTED: December 30, 1959

Card 5/8

S/076/61/035/007/006/019
B127/B102

AUTHORS: Rozenfel'd, I. L., Polteva, M. N., and Persiantseva, V. P.

TITLE: Physicochemical properties of the volatile corrosion inhibitor dicyclohexylamine nitrite

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 7, 1961, 1474-1477

TEXT: The authors studied the physicochemical properties of the widely used dicyclohexylamine nitrite with the empirical formula ($C_{12}H_{24}N_2O_2$) and the lattice constants a = 8.16 ± 0.04Å, b = 8.56 ± 0.04Å, c = 19.32 ± 0.04Å; $P2_12_12_1$, z = 4. In order to determine the vapor pressure of the compound, the effusion method by Knudsen was applied. Table II presents the vapor pressures obtained for different degrees of purity. The heat of sublimation was calculated from the Clausius-Clapeyron equation: σ = 4.575 A = 25.3 kcal/mole. For further clarification, the dipole moment of this compound in dilute benzene solution was measured to be ~4D. It is assumed therefrom that not the salt form exists in dilute solution but a molecular compound of

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S/076/61/035/007/006/019
B127/B102

Physicochemical properties ...

ASSOCIATION: Akademiya nauk SSSR Institut fizicheskoy khimii (Academy of Sciences, USSR Physicochemical Institute)

SUBMITTED: October 12, 1959

Table 2: Vapor pressure of crystalline dicyclohexylamine nitrite in 10^4 mm Hg.
Legend: 1) After 3 recrystallizations; 2) after 7 recrystallizations; 3) after 8 recrystallizations; 4) after 10 recrystallizations.

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18810

S/080/61/034/009/010/016
D204/D305

AUTHORS: Rozenfel'd, I.L., Persiantsyeva, V.P., Terent'yev, P.B. and Polteva, M.N.

TITLE: Investigating the influence of chemical composition and structure of organic compounds on their ability to retard the corrosion process

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 9, 1961. 2047 - 2056

TEXT: This is report I from the series of papers on investigating the mechanism of protection of metals against corrosion by volatile inhibitors. The results of an investigation of the dependence of protective properties of various classes of compounds on their structure and the presence of the functional groups OH, NO_2, NH_2 and complex organic radicals, are reported. In order to carry out these investigations, accelerated methods were developed for testing the protective properties of the compounds, for determining

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Investigating the influence of ...

the pressures of the saturated vapors of volatile inhibitors and the electrochemical behavior of metals under thin films of electrolytes in an atmosphere of volatile inhibitors. The investigation of the protective properties of volatile inhibitors was carried out by imitating corrosion under natural conditions whereby alternate condensation and drying of electrolytes on metal surfaces takes place. The study was carried out in an atmosphere of 100 % relative humidity with 5 cycles of condensation of moisture on the specimens per day. Organic nitrous bases and their salts with weak organic and inorganic acids, complex esters of acids, and inorganic ammonium salts were studied. The protective properties of the compounds were considered to be satisfactory, if no observable corrosion products had formed after 10 days of accelerated tests. It was found that the protective properties of amine salts are determined not only by the radical and the functional group, and thus by the composition of the compound, but also by their structure, on which their adsorptive ability evidently depends. Complex esters of acids and weak aromatic amines cannot be

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Investigating the influence of ...

used as volatile inhibitors, since the former retard corrosion of steel only slightly and the latter not at all. The protective properties of volatile inhibitors are independent of the hydrogen ion concentration established in the moisture film after the latter is saturated with inhibitor vapors. There are 1 figure, 7 tables and 7 references: 4 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: H.R. Backer, Ind. Eng. Ch., 46, 12, 2592, 1954; A. Wachter, T. Sky, N. Stillman, Corrosion, 7, 9, 284, 1951; W.D. Harki, D. Florence, J. Phys. Chem. 6, 847, 1938.

SUBMITTED: July 18, 1960

Card 3/3

27345
S/080/61/034/009/011/016
D204/D305

18.8310

AUTHORS: Rozenfeld, I.L., Polteva, M.N., Persiatsyeva, V.P., and Terent'yev, P.B.

TITLE: Pressure of saturated volatile inhibitor vapors

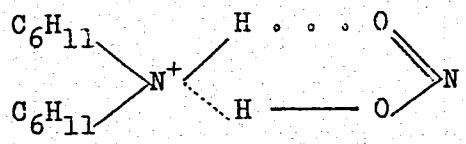
PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 9, 1961, 2056 - 2061

TEXT: This is report II of a series of papers on investigating the mechanism of protection of metals against corrosion by volatile inhibitors. One of the important characteristics of volatile inhibitors is their saturated vapor pressure. Compounds having high vapor pressure are most effective. For the successful application of such inhibitors, the temperature dependence of the pressure of the saturated vapor must also be known. The inclination of the straigth line obtained by plotting negative logarithm of pressure of saturated vapors against 1/T enables the changes of pressure with temperature to be determined, and the temperature range in which an in-

Card 1/3

Pressure of saturated volatile ...

hibitor is effective to be defined. By means of the Knudsen method, the temperature dependence of the pressure of saturated vapors of the volatile inhibitors dicyclohexylamine nitrate and morpholene cinnamate was investigated. On the basis of this dependence, the value of the latent heat of sublimation for di-cyclohexylamine nitrate was calculated (25 Kcal/mol). From a comparison of the value of the latent heat of sublimation and the dipole moment, it is proposed that the structure of di-cyclohexylamine in the vapors is as follows:



There are 3 figures, 1 table and 10 references: 3 Soviet-bloc and 7 non-Soviet-bloc. The references to the 4 most recent English-language publications read as follows: E.G. Stroud, W.H.I. Vernon, J. Applied Chem., 2, 166, 1952; A. Wachter, T. Sky, N. Stillman,

Pressure of saturated volatile ...

Corrosion, 7, 9, 284, 1951; E.G. Stroud, W.H.I. Vernon, U.K. Pat. 691109, 1951; H. Patzelt, Corrosion, 9, 1, 19, 1953.

SUBMITTED: July 18, 1960

4

Card 3/3

L 24435-66 EWT(m)/T/EWP(t) IJP(c) JD/WB/JH
ACC NR: AT6006478 SOURCE CODE: UR/2680/65/000/024/0102/0123

AUTHORS: Tsypin, M. I.; Rozenfel'd, I. L.; Ol'khovnikov, Yu. P.; Vizhekhovskaya, S. V.

ORG: State Scientific Research and Design Institute of Alloys and Nonferrous Metalworking, Moscow (Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut splavov i obrabotki tsvetnykh metallov)

TITLE: Investigation of the corrosion of aluminum in water at high temperatures

SOURCE: Moscow. Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut splavov i obrabotki tsvetnykh metallov. Trudy, no. 24, 1965. Metallovedeniye i obrabotka tsvetnykh metallov i splavov (Metal science and the treatment of nonferrous metals and alloys), 102-123

TOPIC TAGS: aluminum, aluminum compound, corrosion, corrosion rate, intergranular corrosion/ A00 aluminum

ABSTRACT: It was the object of this investigation to resolve the existing controversy concerning the mechanism of the corrosion reaction of aluminum in water at high temperatures, as discussed by V. H. Trautner (Corrosion, 1959, v. 15, No. 1,

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p. 17) and W. J. Bernard and J. J. Randall (Journ. Electrochem, Soc., 1961, v. 108, No. 9, p. 822). The experiments were carried out in steel autoclaves with aluminum specimens of A00 (99.99% Al) type aluminum and distilled water (pH 5.5 ÷ 6.3) over the temperature range of 100--250C. The experimental results followed the relationship

$$\lg \Delta p = n \lg t + \lg k$$

where Δp is the weight increase of the specimen in mg/cm^2, t - the time in hours, and k and n are constants. These results are presented graphically (see Fig. 1).

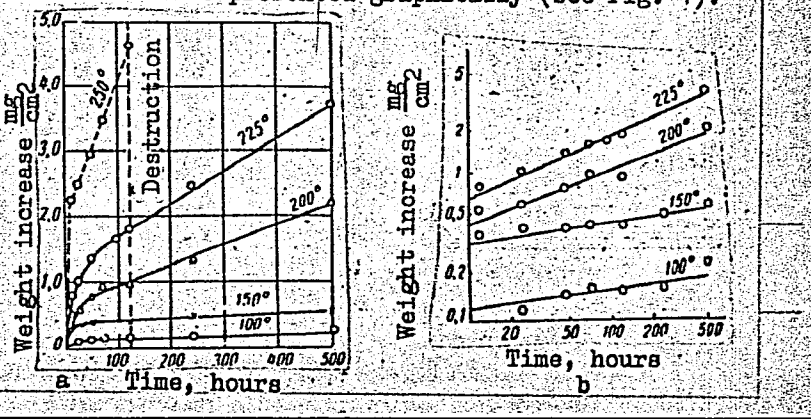

Fig. 1. Kinetics of aluminum oxidation in water at high temperatures. a - linear coordinates; b - logarithmic coordinates.

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The morphology of the corrosion products was studied. Electron microscope pictures of the corrosion products are presented. The phase composition of the corrosion products was investigated by x-ray diffraction and electron diffraction techniques, and the results are also presented in tables and graphs. A scheme for the distribution of corrosion products is proposed (see Fig. 2).

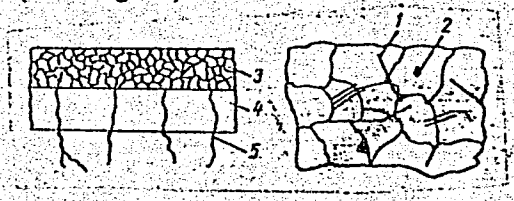

Fig. 2. Scheme for the distribution of products based on the experimental data. 1 - σ phase; 2 - diaspore; 3 - crystal layer; 4 - optically structureless layer; 5 - products of intercrystalline corrosion.

It is concluded that the experimental results support the mechanism proposed by Trautner (see reference above). The authors suggest that the rate of hydrogen ion diffusion into the metal depends on a number of factors, e.g., phase composition, size, form, and degree of perfection and optimum orientation of crystals. Orig. art. has: 5 tables, 10 graphs, and 2 equations.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 004/ OTH REF: 019
Card 3/3 dda

L 40203-66 EWT(m)/EWP(t)/ETI IJP(c) JD/WB

ACC NR: AP6030054 SOURCE CODE: UR/0365/66/002/002/0134/0140

63
B

AUTHOR: Rozenfel'd, I. L.; Danilov, I. S.

ORG: Institute of Physical Chemistry, AN SSSR (Institut fizicheskoy khimii AN SSSR)

TITLE: Electrochemistry of pitting corrosion--I. Formation of pits upon dissolution of stainless steels

SOURCE: Zashchita metallov, v. 2, no. 2, 1966, 134-140

TOPIC TAGS: electrochemistry, corrosion resistant steel, stainless steel, current density/Kh18N10T stainless steel

ABSTRACT: The electrochemical behavior of steel Kh18N10T was studied under conditions of hydrogen attack. The preimary electrochemical characteristics of the material as an electrode were determined.

It was established that plate current density in specific pits is 1,400-1,700 ma/cm^2 which is 5-6 times greater that the dissolving rate of a passive steel. It was shown that there is an exclusively non-uniform distribution of anode current in these pits--rate of dissolving differs by 30-40 times. Average current density in the pits does not remain constant with time but decreases hyperbolically, while areas of pitting increases linearly.

Distribution of voltage and current density at the electrode undergoing pitting corrosion were studied. It was found that along the electrode surface there is a significant potential gradient (100 mv/mm). Average cathode current density at the passive surface is 0.4-0.6 ma/cm^2 which is 2-3 times less than anode current density. Orig. art. has: 8 figures and 2 formulas. [JPRS: 35,432]

SUB CODE: 07, 11, 20, 09 / SUBM DATE: 05Aug65 / ORIG REF: 011 / OTH REF: 011

UDC: 620.193.01

Card 1/1

0918 0649

L 28536-66 EWP(j)/EWT(m)/T/EWP(t)/ETI IJP(c) RM/WW/JD/WB/GD

ACC NR: AT6013805 SOURCE CODE: UR/0000/65/000/000/0305/0314

AUTHOR: Rozenfel'd, I. L.; Persiantseva, V. P.

53
B+1

ORG: none

TITLE: Mechanism of the inhibition of metal corrosion by ammonia

SOURCE: Korroziya metallov i splavov (Corrosion of metals and alloys), no. 2. Moscow, Izd-vo Metallurgiya, 1965, 305-314

TOPIC TAGS: corrosion inhibitor, ammonia, steel, surface ionization, hydrolysis

ABSTRACT: Recently, to improve the effectiveness of the corrosion protection of metals in storage and transport, ammonia salts and other compounds capable of releasing ammonia during hydrolysis and dissociation have begun to be added to the standard inhibitors (e.g. $NaNO_3$). It is generally assumed that the mechanism of protective effect may then manifest itself in one of the following phenomena: a) NH_3 displaces the pH of the medium to the region of low corrosive activity; b) NH_3 (or NH_4OH) binds the aggressive component of the medium (e.g. CO_2); c) the mixing of NH_3 salts with $NaNO_3$ leads to the formation of the highly volatile NH_4NO_3. Since these assumptions lacked experimental proof, the authors decided to investigate the protective capacity of NH_3 as a function of its content in the atmosphere, as well as to investigate the effect of NH_3 on the electrochemical behavior of steel. The in-

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ACC NR: AT6013805

vestigation pertained to NH_3 of 100% relative humidity at 25°C, on varying its concentration by placing in the reaction vessel NH_4OH of various concentrations corresponding to ammonia vapor pressures of from 66.66 to 666.6 n/m^2 (0.5 to 5 mm Hg), with the corrosion being determined as a function of time until the appearance of first signs of corrosion on the steel specimens. These experiments showed that even insignificant concentrations of NH_3 in the atmosphere (266.64 n/m^2 or 2 mm Hg) can effectively protect steel against corrosion. An attendant investigation of the electrochemical behavior of steel in NH_3 atmosphere showed that the presence of NH_3 displaces the steel's potential by 500 mv in the positive direction. The mechanism of the protection of steel by NH_3 is due to the hydration of NH_3 and the concomitant formation of NH_3 ions. The prior adsorption of hydroxyl ions on the (positively charged) surface of steel makes possible the adsorption of NH_3 ions on the metal surface, which leads to a sharp change in the ionization rate of Fe. These findings are also highly significant to the determination of the mechanism of the protective effect of other amine-class compounds which, in solutions, form cations similar to the NH_3 ion. Orig. art. has: 7 figures and 4 formulas.

SUB CODE: 11,11,10720/ SUBM DATE: 19Jul65/ ORIG REF: 005/ OTH REF: 003

Card 2/2

L 28537-66 EWP(j)/EWT(m)/T/EWP(t)/ETI IJP(c) RM/WW/JD/WB/GD

ACC NR: AT6013804 SOURCE CODE: UR/0000/65/000/000/0296/0304

57

AUTHOR: Rozenfel'd, I. L.; Persiantseva, V. P.; Gulyayeva, I. P.

ORG: none

TITLE: Protective properties of inorganic inhibitors in the presence of extraneous ions

SOURCE: Korroziya metallov i splavov (Corrosion of metals and alloys), no. 2. Moscow, Izd-vo Metallurgiya, 1965, 296-304

14

TOPIC TAGS: corrosion inhibitor, ion, sodium compound, sulfate, chloride, electrolyte

ABSTRACT: Inorganic inhibitors, which chiefly include sodium and potassium salts of acids whose anions contain atoms of elements V, IV and VII of the periodic table, are widely used to protect metals against corrosion in neutral media. Yet despite the numerous studies of these inhibitors, the interaction between inhibiting and aggressive media still has not been adequately investigated and hence the effectiveness of the inhibitors in various electrolytes cannot be predicted. To fill this gap, the authors investigated the corrosion rate of Fe as a function of inhibitor concentration for a fixed concentration of aggressive ions (Cl^-, SO_4^{2-}). In addition the protective concentrations of inhibitors for various concentrations of aggressive ions were investigated; this made it possible to derive a mathematical relation for

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calculating the required amount of inhibitor for real systems. Thus the dependence of the protective concentration of such compounds as Na_2WO_4, Na_3PO_4, Na_2MoO_4, NaH_2PO_4 on the content of sulfate ions (SO_4^{2-}) in the solution is expressed by the equation: $Y = 0.17X + 0.003$, where Y is molal inhibitor concentration, and X is molal concentration of aggressive ion. For the aggressive ion Cl^- the corresponding relation is: $Y = 0.38X + 0.005$. The accompanying electrochemical tests pertained to electrode impedance which, as was anticipated, differed depending on whether the inhibitor forms phase layers or adsorption layers at the surface of the protected metal. The corrosion rate of metal as a function of inhibitor concentration in a solution of 30 mg/liter NaCl and 70 mg/liter Na_2SO_4 was found to decrease in all cases -- except monosubstituted phosphate and sodium vanadate -- with increasing inhibitor concentration (Fig. 1). Thus, the investigated inhibitors may be arranged in the following series of increasing protective capacity:

$$Na_3PO_4 \approx Na_2HPO_4 > Na_2WO_4 > Na_2MoO_4 > NaH_2PO_4 > Na_2VO_4.$$

It is found that these inhibitors markedly alter impedance when the current applied is small, do not affect capacitance characteristics in the presence of high frequencies but somewhat reduce ohmic resistance at these frequencies. Such changes in impedance indicate that inhibitors of this type (XO_4^{n-}) alter the polarization characteristics of the system. Orig. art. has: 9 figures.